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EXAMINER	
BAREFORD, KATHERINE A	
ART UNIT	**PAPER NUMBER**
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/733,740	PHILIP ET AL.	
	Examiner	Art Unit	
	Katherine A. Bareford	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 12 October 2007.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-27 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-23 and 27 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Claims 24-26

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. The amendment filed October 12, 2007 (in response to the Notice of Non-Compliant Amendment of September 20, 2007) has been received and entered. With the entry of the amendment, claims 24-26 are canceled, and claims 1-23 and 27 are pending for examination.

Claim Rejections - 35 USC § 112

2. The rejection of claims 1-12, 22, 23 and 27 under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement is withdrawn due to applicant's removal of the material indicated as new matter in the amendment of October 12, 2007.

3. The rejection of claims 1-23 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention is withdrawn due to applicant's removal of the material indicated as unclear in the amendment of October 12, 2007.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Longo et al (US 44501184) (hereinafter Longo '184).

Longo '184 teaches a method of applying a zirconia (zirconium oxide) based thermal barrier coating. *Column 1, lines 40-50, column 2, lines 25-50 and column 3, lines 5-20.* The applied coating can be porous. *Column 1, lines 40-50, column 4, lines 55-60, and column 5, lines 5-10.* The method includes selecting a composite powder comprising a first constituent that can comprise stabilized zirconia particles. *Column 2, lines 25-50, column 3, lines 5-20 and column 4, lines 60-68 (stabilized zirconia can be used).* The powder also can have a second constituent that can comprise a second ceramic material, such as

titanium oxide or cerium oxide. *Column 3, lines 5-20 and column 4, lines 60-68 (note that combinations of the listed materials can be used). (It would have been obvious to select materials from the lists provided by Longo '184 to make a composite powder with an expectation of desirable coating results, as the selection of such materials is taught by Longo '184).* The powder would be a homogenous mixture of the materials. *Column 3, lines 55-60.* The powder is made by mixing the first and second constituent powder particles together. *Column 3, lines 5-68 (with the blending, mixing of slip, spray drying process, and fusing).* The second ceramic material can have a melting temperature sufficiently low so that the second constituent particles can at least partially melt when applied. *Column 3, lines 5-20 and column 4, lines 60-68 (given the melting temperatures of cerium oxide (1950 degrees C) and titanium oxide (1640 degrees C) these particles would melt under conventional flame spraying conditions required to at least heat soften the zirconia (melting temperature approximately 2700 degrees C), which is taught at column 1, lines 10-15, where it is indicated that flame spray would involve at least "heat softening" of the coating material).* The composite powder can be applied by thermal spraying using a conventional powder-type flame spray equipment (which would be a low velocity oxygen fuel process/LVOF) to provide a porous coating. *Column 2, lines 45-50 and column 1, lines 5-40 and column 4, lines 55-60, as to the term "low velocity oxygen fuel process", this term was not defined in the disclosure as filed, so the Examiner has based her understanding of the term based on the "plain meaning" or ordinary and customary meaning of the term by those of ordinary skill in the art (See MPEP 2111.01), and it is the Examiner's position that as demonstrated by the art in the*

case, the combustion powder thermal spray process, i.e. the flame spray process, is equated to a "low velocity oxygen fuel process". The composite powder can also be applied by plasma spraying (another form of thermal spraying). *Column 2, lines 45-50 and column 1, lines 5-30.* The composite spray powder used can also include other ordinary flame spray powders. *Column 5, lines 15-25.*

Longo '184 teaches all the features of these claims except that the LVOF process actually at least partially melts the titanium/cerium oxide particles.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Longo '184 to at least partially melt the titanium oxide or cerium oxide particles when spraying the composite powder containing zirconia and titanium oxide or cerium oxide with powder flame spraying (LVOF spraying) in order to provide a desirably dense (including porous) and bonded coating, because Longo '184 teaches that conventional flame spray processes at least heat softens the coating material when spraying, and given the melting temperatures of cerium oxide (1950 degrees C) and titanium oxide (1640 degrees C) these particles would melt under conventional flame spraying conditions required to at least heat soften the zirconia (melting temperature approximately 2700 degrees C) constituent of the composite powder.

7. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Longo et al (US 44501184) (hereinafter Longo '184) in view of Nagaraj et al (US 2005/0191516) (hereinafter Nagaraj '516).

Longo '184 teaches a method of applying a zirconia (zirconium oxide) based thermal barrier coating. *Column 1, lines 40-50, column 2, lines 25-50 and column 3, lines 5-20.* The applied coating can be porous. *Column 1, lines 40-50, column 4, lines 55-60, and column 5, lines 5-10.* The method includes selecting a composite powder comprising a first constituent that can comprise stabilized zirconia particles. *Column 2, lines 25-50, column 3, lines 5-20 and column 4, lines 60-68 (stabilized zirconia can be used).* The powder also can have a second constituent that can comprise a second ceramic material, such as titanium oxide or cerium oxide. *Column 3, lines 5-20 and column 4, lines 60-68 (note that combinations of the listed materials can be used). (It would have been obvious to select materials from the lists provided by Longo '184 to make a composite powder with an expectation of desirable coating results, as the selection of such materials is taught by Longo '184).* The powder would be a homogenous mixture of the materials. *Column 3, lines 55-60.* The powder is made by mixing the first and second constituent powder particles together. *Column 3, lines 5-68 (with the blending, mixing of slip, spray drying process, and fusing).* The second ceramic material can have a melting temperature sufficiently low so that the second constituent particles can at least partially melt when applied. *Column 3, lines 5-20 and column 4, lines 60-68 (given the melting temperatures of cerium oxide (1950 degrees C) and titanium oxide (1640 degrees C) these particles would melt under conventional flame*

spraying conditions required to at least heat soften the zirconia (melting temperature approximately 2700 degrees C), which is taught at column 1, lines 10-15, where it is indicated that flame spray would involve at least "heat softening" of the coating material). The composite powder can be applied by thermal spraying using a conventional powder-type flame spray equipment (which would be a low velocity oxygen fuel process/LVOF). *Column 2, lines 45-50 and column 1, lines 5-40, as to the term "low velocity oxygen fuel process", this term was not defined in the disclosure as filed, so the Examiner has based her understanding of the term based on the "plain meaning" or ordinary and customary meaning of the term by those of ordinary skill in the art (See MPEP 2111.01), and it is the Examiner's position that as demonstrated by the art in the case, the combustion powder thermal spray process, i.e. the flame spray process, is equated to a "low velocity oxygen fuel process".* The composite powder can also be applied by plasma spraying (another form of thermal spraying). *Column 2, lines 45-50 and column 1, lines 5-30.* The composite spray powder used can also include other ordinary flame spray powders. *Column 5, lines 15-25.*

Longo '184 teaches all the features of these claims except that the LVOF process actually at least partially melts the titanium/cerium oxide particles and the repair of the component while in the machine.

However, Nagaraj '516 teaches that it is well known to need to repair a zirconia based thermal barrier coating. *Paragraphs [0025] and [0032].* Access to a damaged region of a coating on a component in a machine is provided. *Paragraphs [0032] (the part can be in an assembled state) and [0037].* The damaged region is cleaned. *Paragraph [0037] (note*

the treatment with water, etc.) Then, a thermal spraying process, plasma spraying, is used to apply repair material to the damaged region without removing the component from the machine. *Paragraphs [0032], [0039], [0040].*

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Longo '184 to at least partially melt the titanium oxide or cerium oxide particles when spraying the composite powder containing zirconia and titanium oxide or cerium oxide with powder flame spraying (LVOF spraying) in order to provide a desirably dense (including porous) and bonded coating, because Longo '184 teaches that conventional flame spray processes at least heat softens the coating material when spraying, and given the melting temperatures of cerium oxide (1950 degrees C) and titanium oxide (1640 degrees C) these particles would melt under conventional flame spraying conditions required to at least heat soften the zirconia (melting temperature approximately 2700 degrees C) constituent of the composite powder. It would further have been obvious to one of ordinary skill in the art at the time the invention was made to modify Longo '184 to use the process for on machine repair as suggested by Nagaraj '516, in order to provide a desirable repaired barrier layer, because Longo '184 teaches to provide a thermal barrier layer using stabilized zirconia and other ceramic particles and that multiple materials can be present, and Nagaraj '516 teaches thermal spraying ceramic materials to provide repaired zirconia based thermal barrier coatings without disassembling. It would further have been obvious to use the thermal spraying method of flame spraying (LVOF spraying) as well

as plasma spraying to provide the thermal barrier coating with an expectation of desirable coating results, because while Nagaraj '516 teaches plasma spraying, Longo '184 teaches that the specific barrier coating compositions taught by Longo '184 can be provided by either flame or plasma spraying with desirable coating results.

8. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Longo et al (US 44501184) (hereinafter Longo '184) in view of Nagaraj et al (US 2005/0191516) (hereinafter Nagaraj '516) and Dittrich (US 3617358).

Longo '184 teaches a method of applying a zirconia (zirconium oxide) based thermal barrier coating. *Column 1, lines 40-50, column 2, lines 25-50 and column 3, lines 5-20.* The applied coating can be porous. *Column 1, lines 40-50, column 4, lines 55-60, and column 5, lines 5-10.* The method includes selecting a composite powder comprising a first constituent that can comprise stabilized zirconia particles. *Column 2, lines 25-50, column 3, lines 5-20 and column 4, lines 60-68 (stabilized zirconia can be used).* The powder also can have a second constituent that can comprise a second ceramic material, such as titanium oxide or cerium oxide. *Column 3, lines 5-20 and column 4, lines 60-68 (note that combinations of the listed materials can be used). (It would have been obvious to select materials from the lists provided by Longo '184 to make a composite powder with an expectation of desirable coating results, as the selection of such materials is taught by Longo '184).* The second ceramic material can have a melting temperature sufficiently low so that the second constituent particles can at least partially melt when applied. *Column 3, lines 5-20 and*

column 4, lines 60-68 (given the melting temperatures of cerium oxide (1950 degrees C) and titanium oxide (1640 degrees C) these particles would melt under conventional flame spraying conditions required to at least heat soften the zirconia (melting temperature approximately 2700 degrees C), which is taught at column 1, lines 10-15, where it is indicated that flame spray would involve at least "heat softening" of the coating material). The powder would be a homogenous mixture of the materials. *Column 3, lines 55-60.* The composite powder can be applied by thermal spraying using a conventional powder-type flame spray equipment (which would be a low velocity oxygen fuel process/LVOF). *Column 2, lines 45-50 and column 1, lines 5-40, as to the term "low velocity oxygen fuel process", this term was not defined in the disclosure as filed, so the Examiner has based her understanding of the term based on the "plain meaning" or ordinary and customary meaning of the term by those of ordinary skill in the art (See MPEP 2111.01), and it is the Examiner's position that as demonstrated by the art in the case, the combustion powder thermal spray process, i.e. the flame spray process, is equated to a "low velocity oxygen fuel process".* The composite powder can also be applied by plasma spraying (another form of thermal spraying). *Column 2, lines 45-50 and column 1, lines 5-30.* The composite spray powder used can also include other ordinary flame spray powders. *Column 5, lines 15-25.* Long '184 teaches that particles are formed by a process that can include the spray drying process of US Patent No. 3,617,358. *Column 2, lines 50-60.* Longo '184 also teaches that the powdered raw materials are blended together as part of the particle making process. *Column 3, lines 5-20.*

Longo '184 teaches all the features of these claims except that the LVOF process actually at least partially melts the titanium/cerium oxide particles, the repair of the component while in the machine, and the use of "ball milling".

However, Nagaraj '516 teaches that it is well known to need to repair a zirconia based thermal barrier coating. *Paragraphs [0025] and [0032].* Access to a damaged region of a coating on a component in a machine is provided. *Paragraphs [0032] (the part can be in an assembled state) and [0037].* The damaged region is cleaned. *Paragraph [0037] (note the treatment with water, etc.)* Then, a thermal spraying process, plasma spraying, is used to apply repair material to the damaged region without removing the component from the machine. *Paragraphs [0032], [0039], [0040].*

Dittrich teaches that when making agglomerated particles of two main constituents by spray drying, the constituents can first be mixed by ball milling to form a combined particle. *Column 7, lines 55-65.* Then a spray drying process occurs. *Column 7,line 55 through column 9, line 35.*

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Longo '184 to at least partially melt the titanium oxide or cerium oxide particles when spraying the composite powder containing zirconia and titanium oxide or cerium oxide with powder flame spraying (LVOF spraying) in order to provide a desirably dense (including porous) and bonded coating, because Longo '184 teaches that conventional flame spray processes at least heat softens the coating material when spraying, and given the melting temperatures of cerium oxide (1950

degrees C) and titanium oxide (1640 degrees C) these particles would melt under conventional flame spraying conditions required to at least heat soften the zirconia (melting temperature approximately 2700 degrees C) constituent of the composite powder. It would further have been obvious to one of ordinary skill in the art at the time the invention was made to modify Longo '184 to use the process for on machine repair as suggested by Nagaraj '516, in order to provide a desirable repaired barrier layer, because Longo '184 teaches to provide a thermal barrier layer using stabilized zirconia and other ceramic particles and that multiple materials can be present, and Nagaraj '516 teaches thermal spraying ceramic materials to provide repaired zirconia based thermal barrier coatings without disassembling. It would further have been obvious to use the thermal spraying method of flame spraying (LVOF spraying) as well as plasma spraying to provide the thermal barrier coating with an expectation of desirable coating results, because while Nagaraj '516 teaches plasma spraying, Longo '184 teaches that the specific barrier coating compositions taught by Longo '184 can be provided by either flame or plasma spraying with desirable coating results. It would further have been obvious to modify Longo '184 in view of Nagaraj to use ball milling when making the composite powder as suggested by Dittrich, in order to provide a desirable powder because Longo '184 teaches to use a powder making process as described by Dittrich (US 3617358) and Dittrich teaches to use ball milling as part of the composite powder making process.

9. Claims 14-15 and 17-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Longo '184 in view of Nagaraj '516 and Dittrich as applied to claim 13 above and further in view of Japan 2002-275615 (hereinafter '615).

Longo '184 in view of Nagaraj '516 and Dittrich teaches all the features of these claims except (1) the calcium or strontium titanate (claims 14-15) and (2) the coefficient of thermal expansions (claims 17-19).

However, '615 teaches that a desirable material to be applied by thermal spraying to a substrate to form a thermal barrier coating is calcium titanate ($CaTiO_3$), which can be applied with yttria stabilized zirconia. *See the abstract.*

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Longo '184 in view of Nagaraj '516 and Dittrich to use calcium titanate particles as suggested by '615 with the stabilized zirconia—titanium oxide particles of Longo '184, in order to provide a desirable barrier layer, because Longo '184 in view of Nagaraj '516 and Dittrich teaches to provide a thermal barrier layer using stabilized zirconia and particles that can be titanium oxide and that multiple materials can be present, and '615 teaches the desirability of using stabilized zirconia and to add a form of titanium oxide, calcium titanate, to form thermal barrier coatings. Given the temperature of spraying, the titanate would also partially melt. Furthermore, it would further have been obvious to modify Longo '184 in view of Nagaraj '516 and Dittrich in view of '615 to use strontium titanate with an expectation of providing a desirable thermal barrier coating, because Longo '184 in view of Nagaraj '516 and

Dittrich and '615 indicate the desirability of using stabilized zirconia and titanium oxide materials when forming thermal barrier coatings, and it is the Examiner's position that strontium titanate is a well known titanium oxide material. As a result of using the stabilized zirconia and specific titanium oxide materials, the claimed ranges of the coefficients of thermal expansion would be inherently provided as in claims 17-19.

10. Claims 16 and 20-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Longo '184 in view of Nagaraj '516 and Dittrich as applied to claim 13 above, and further in view of Spitsberg et al (US 2003/0027012).

Longo '184 in view of Nagaraj '516 and Dittrich teaches all the features of these claims except (1) the sodium-zirconium-phosphate-silicate (claim 16) and (2) the thermal conductivity (claims 20-21).

However, Spitsberg teaches that a desirable material to be applied by thermal spraying to a substrate to form a thermal barrier coating is zirconium phosphate materials (NZP-family materials), including sodium zirconate phosphate, which are applied with yttria stabilized zirconia (YSZ). *Paragraphs [0022] and [0025].*

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Longo '184 in view of Nagaraj '516 and Dittrich to use NZP material particles as suggested by Spitsberg with the stabilized zirconia—titanium oxide particles of Longo '184, in order to provide a desirable barrier layer, because Longo '184 in view of Nagaraj '516 and Dittrich teaches to provide a thermal barrier

layer using stabilized zirconia and other ceramic particles and that multiple materials can be present, and Spitsberg teaches the desirability of using stabilized zirconia and a form of NZP materials to form thermal barrier coatings. Given the temperature of spraying, the NZP materials would also at least partially melt. It would further have been obvious to modify Longo '184 in view of Nagaraj '516 and Dittrich in view of Spitsberg to use sodium-zirconium-phosphate-silicate with an expectation of providing a desirable thermal barrier coating, because Longo '184 in view of Nagaraj '516 and Dittrich and Spitsberg indicate the desirability of using stabilized zirconia and NZP materials, including those with sodium zirconate phosphate when forming thermal barrier coatings, and it is the Examiner's position that sodium-zirconium-phosphate-silicatis a well known NZP material. As a result of using the stabilized zirconia and NZP materials, the claimed ranges of the coefficients of thermal conductivity would be inherently provided as in claims 20-21.

11. Claims 6, 7, 23 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Longo et al (US 44501184) (hereinafter Longo '184) in view of EITHER Bryan et al (US 5268946) OR Mons et al (US 4423097).

Longo '184 teaches a method of applying a zirconia (zirconium oxide) based thermal barrier coating. *Column 1, lines 40-50, column 2, lines 25-50 and column 3, lines 5-20.* The applied coating can be porous. *Column 1, lines 40-50, column 4, lines 55-60, and column 5, lines 5-10.* The method includes selecting a composite powder comprising a

first constituent that can comprise stabilized zirconia particles. *Column 2, lines 25-50, column 3, lines 5-20 and column 4, lines 60-68 (stabilized zirconia can be used).* The powder also can have a second constituent that can comprise a second ceramic material, such as titanium oxide or cerium oxide. *Column 3, lines 5-20 and column 4, lines 60-68 (note that combinations of the listed materials can be used). (It would have been obvious to select materials from the lists provided by Longo '184 to make a composite powder with an expectation of desirable coating results, as the selection of such materials is taught by Longo '184).* The powder would be a homogenous mixture of the materials. *Column 3, lines 55-60.* The powder is made by mixing the first and second constituent powder particles together. *Column 3, lines 5-68 (with the blending, mixing of slip, spray drying process, and fusing).* The second ceramic material can have a melting temperature sufficiently low so that the second constituent particles can at least partially melt when applied. *Column 3, lines 5-20 and column 4, lines 60-68 (given the melting temperatures of cerium oxide (1950 degrees C) and titanium oxide (1640 degrees C) these particles would melt under conventional flame spraying conditions required to at least heat soften the zirconia (melting temperature approximately 2700 degrees C), which is taught at column 1, lines 10-15, where it is indicated that flame spray would involve at least "heat softening" of the coating material).* The composite powder can be applied by thermal spraying using a conventional powder-type flame spray equipment (which would be a low velocity oxygen fuel process/LVOF) to provide a porous coating. *Column 2, lines 45-50 and column 1, lines 5-40 and column 4, lines 55-60, as to the term "low velocity oxygen fuel process", this term was not defined in the*

disclosure as filed, so the Examiner has based her understanding of the term based on the "plain meaning" or ordinary and customary meaning of the term by those of ordinary skill in the art (See MPEP 2111.01), and it is the Examiner's position that as demonstrated by the art in the case, the combustion powder thermal spray process, i.e. the flame spray process, is equated to a "low velocity oxygen fuel process". The composite powder can also be applied by plasma spraying (another form of thermal spraying). *Column 2, lines 45-50 and column 1, lines 5-30.* The composite spray powder used can also include other ordinary flame spray powders. *Column 5, lines 15-25.* Longo'184 also teaches that the nature of a coating obtained by flame spray a metal or ceramic powder can be quite specifically controlled by proper selection of the composition of the powder, control of the physical nature of the powder and use of select flame spraying conditions. *Column 1, lines 29-40.*

Claims 6-7: the powder can be 50 mol percent zirconia and 50 mol percent magnesium oxide, and thus can be greater than 20 volume percent of another material, for example. *Column 3, lines 15-20.*

Claim 23: the void percentage can be 15-50 percent. *Column 5, lines 5-10.* Longo '184 further teaches that desirable abradable thermal barrier coatings have 20-35 % porosity. *Column 1, lines 40-50.*

Longo '184 teaches all the features of these claims except that the LVOF process actually at least partially melts the titanium/cerium oxide particles, that the second constituent encases the first constituent when the barrier coating is applied, the precise amount of the second material (claims 6-7) and the precise void percentages (claim 23).

Bryan teaches that a flame spray coating mixture can comprise high melting temperature ceramic particles such as zircon, and lower melting glass (from the materials, the glasses would also be ceramic) particles. *Column 2, lines 15-45.* The mixture is flame sprayed under conditions so that the high melting temperature ceramic particles do not melt and the lower melting temperature glass particles become at least semi-molten. *Column 2, lines 40-50.* The resulting spray provides a coating where the high temperature ceramic is encased in the low melting temperature glass. *Figure 2 and column 4, lines 15-35.*

Mons teaches a thermal spraying process including oxy-acetylene gun spraying (flame spraying). *Column 2, lines 1-6.* High temperature melting hollow microspheres are provided in a mixture with binder metal that has a lower melting temperature. *Column 2, lines 5-15.* During spraying the homogeneous mixture of materials sprayed, so that the binder bonds together and encases the microspheres. *Column 2, lines 15-30 and figure 2.*

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Longo '184 to at least partially melt the titanium oxide or cerium oxide particles when spraying the composite powder containing zirconia and titanium oxide or cerium oxide with powder flame spraying (LVOF spraying) in order to provide a desirably dense (including porous) and bonded coating, because Longo '184 teaches that conventional flame spray processes at least heat softens the coating material when spraying, and given the melting temperatures of cerium oxide (1950

degrees C) and titanium oxide (1640 degrees C) these particles would melt under conventional flame spraying conditions required to at least heat soften the zirconia (melting temperature approximately 2700 degrees C) constituent of the composite powder. Furthermore, it would have been obvious to perform routine experimentation to optimize the amount of the second constituent when performing the process of Longo '184, given the variety of materials that can be used as the second constituent, and as noted in MPEP 2144.05, "Generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)". Furthermore, it would have been obvious to perform routine experimentation to optimize the void percentage from within the range taught by Longo '184 given the teaching of Longo '184 as to what a desired range of porosity for abradable thermal barrier coatings is, as in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976). It would further have been obvious to modify Longo '184 to optimize spraying conditions to control the resulting coating structure and features and that as a result of the control of the spraying process, the second constituent would encase the first constituent when the thermal barrier coating is applied to a surface as suggested by EITHER Bryan OR Mons

in order to provide a desirable coating structure for use, because Longo '184 teaches that it is well known to desirably control the flame spraying conditions and powder composition to control the nature of the coating produced, that heat softening or melting is provided in flame spraying, and further that as discussed above, when the zirconia is at least heat softened the lesser melting point temperature ceramics will have melted, and as shown by both Bryan and Mons, during a flame spraying process when using a lower melting temperature material in mixture with a higher temperature material, the lower melting temperature material will encase the higher melting constituent, which has not melted. This would allow for spraying with the expenditure of less energy as not all material needs to be melted.

12. Claims 2-3 and 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Longo '184 in view of EITHER Bryan OR Mons as applied to claims 6, 7, 23 and 27 above and further in view of Japan 2002-275615 (hereinafter '615).

Longo '184 in view of EITHER Bryan OR Mons teaches all the features of these claims except (1) the calcium or strontium titanate (claims 2-3) and (2) the coefficient of thermal expansions (claims 8-10).

However, '615 teaches that a desirable material to be applied by thermal spraying to a substrate to form a thermal barrier coating is calcium titanate ($CaTiO_3$), which can be applied with yttria stabilized zirconia. *See the abstract.*

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Longo '184 in view of EITHER Bryan OR Mons to use calcium titanate particles as suggested by '615 with the stabilized zirconia—titanium oxide particles of Longo '184, in order to provide a desirable barrier layer, because Longo '184 in view of EITHER Bryan OR Mons teaches to provide a thermal barrier layer using stabilized zirconia and particles that can be titanium oxide and that multiple materials can be present, and '615 teaches the desirability of using stabilized zirconia and to add a form of titanium oxide, calcium titanate, to form thermal barrier coatings. Given the temperature of spraying, the titanate would also partially melt. Furthermore, it would further have been obvious to modify Longo '184 in view of EITHER Bryan OR Mons in view of '615 to use strontium titanate with an expectation of providing a desirable thermal barrier coating, because Longo '184 in view of EITHER Bryan OR Mons and '615 indicate the desirability of using stabilized zirconia and titanium oxide materials when forming thermal barrier coatings, and it is the Examiner's position that strontium titanate is a well known titanium oxide material. As a result of using the stabilized zirconia and specific titanium oxide materials, the claimed ranges of the coefficients of thermal expansion would be inherently provided as in claims 8-10.

13. Claims 4 and 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Longo '184 in view of EITHER Bryan OR Mons as applied to claims 6, 7, 23 and 27 above, and further in view of Spitsberg et al (US 2003/0027012).

Longo '184 in view of EITHER Bryan OR Mons teaches all the features of these claims except (1) the sodium-zirconium-phosphate-silicate (claim 4) and (2) the thermal conductivity (claims 11-12).

However, Spitsberg teaches that a desirable material to be applied by thermal spraying to a substrate to form a thermal barrier coating is zirconium phosphate materials (NZP-family materials), including sodium zirconate phosphate, which are applied with yttria stabilized zirconia (YSZ). *Paragraphs [0022] and [0025].*

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Longo '184 in view of EITHER Bryan OR Mons to use NZP material particles as suggested by Spitsberg with the stabilized zirconia – titanium oxide particles of Longo '184, in order to provide a desirable barrier layer, because Longo '184 in view of EITHER Bryan OR Mons teaches to provide a thermal barrier layer using stabilized zirconia and other ceramic particles and that multiple materials can be present, and Spitsberg teaches the desirability of using stabilized zirconia and a form of NZP materials to form thermal barrier coatings. Given the temperature of spraying, the NZP materials would also at least partially melt. It would further have been obvious to modify Longo '184 in view of EITHER Bryan OR Mons in view of Spitsberg to use sodium-zirconium-phosphate-silicate with an expectation of providing a desirable thermal barrier coating, because Longo '184 in view of EITHER Bryan OR Mons and Spitsberg indicate the desirability of using stabilized zirconia and NZP materials, including those with sodium zirconate phosphate when forming thermal

barrier coatings, and it is the Examiner's position that sodium-zirconium-phosphate-silicatis a well known NZP material. As a result of using the stabilized zirconia and NZP materials, the claimed ranges of the coefficients of thermal conductivity would be inherently provided as in claims 11-12.

14. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Longo '184 in view of EITHER Bryan OR Mons as applied to claims 6, 7, 23 and 27 above, and further in view of Nagaraj et al (US 2005/0191516) (hereinafter Nagaraj '516).

Longo '184 in view of EITHER Bryan OR Mons teaches all the features of these claims except the repair of the component while in the machine.

However, Nagaraj '516 teaches that it is well known to need to repair a zirconia based thermal barrier coating. *Paragraphs [0025] and [0032].* Access to a damaged region of a coating on a component in a machine is provided. *Paragraphs [0032] (the part can be in an assembled state) and [0037].* The damaged region is cleaned. *Paragraph [0037] (note the treatment with water, etc.)* Then, a thermal spraying process, plasma spraying, is used to apply repair material to the damaged region without removing the component from the machine. *Paragraphs [0032], [0039], [0040].*

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Longo '184 in view of EITHER Bryan OR Mons to use the process for on machine repair as suggested by Nagaraj '516, in order to provide a desirable repaired barrier layer, because Longo '184 in view of EITHER Bryan OR Mons

teaches to provide a thermal barrier layer using stabilized zirconia and other ceramic particles and that multiple materials can be present, and Nagaraj '516 teaches thermal spraying ceramic materials to provide repaired zirconia based thermal barrier coatings without disassembling. It would further have been obvious to use the thermal spraying method of flame spraying (LVOF spraying) as well as plasma spraying to provide the thermal barrier coating with an expectation of desirable coating results, because while Nagaraj '516 teaches plasma spraying, Longo '184 teaches that the specific barrier coating compositions taught by Longo '184 can be provided by either flame or plasma spraying with desirable coating results.

Response to Arguments

15. Applicant's arguments filed October 12, 2007 have been fully considered but they are not persuasive.

(A) As to the arguments as to the 35 USC 112, first paragraph, new matter rejection and 35 USC 112, second paragraph, rejection, these rejections have been withdrawn due to applicant's amendments to clarify the claims and remove new matter.

(B) As to the rejection under 35 USC 103, applicant argues that claims 5 and 13-21 have been amended to overcome the Examiner's Section 103 rejections.

The Examiner have reviewed these arguments, however, the rejections above are maintained. Applicant's arguments do not comply with 37 CFR 1.111(c) because they

do not clearly point out the patentable novelty which he or she thinks the claims present in view of the state of the art disclosed by the references cited or the objections made. Further, they do not show how the amendments avoid such references or objections. A mere statement that the claims have been amended to overcome the Examiner's Section 103 rejections gives no indication as to what aspect of the claims is specifically not provided by the rejections above. Independent claim 5 has been amended to provide that the constituents are mixed, and the Examiner, in the rejection above, has pointed out where this is taught by Longo '184. Independent claim 13 has been amended to remove "wet chemical mixing", thus providing mixing by "ball milling" is present. The Examiner, in the rejection above, has pointed out where this is taught by Longo '184.

(C) As to the new rejections of claim 1, 27 and the claims dependent from claim 27, these rejections have been provided in response to the new requirements of the claims.

Conclusion

16. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Katherine A. Bareford whose telephone number is (571) 272-1413. The examiner can normally be reached on M-F(6:00-3:30) with the First Friday Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on (571) 272-1423. The fax phone numbers for the organization where this application or proceeding is assigned are (571) 273-8300 for regular communications and for After Final communications.

Other inquiries can be directed to the Tech Center 1700 telephone number at (571) 272-1700.

Furthermore, information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KATHERINE BAREFORD
PRIMARY EXAMINER